

**JAPANESE** [JP,07-136471,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM  
MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

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CLAIMS

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[Claim(s)]

[Claim 1] A hollow fiber bunch is contained in an outer case, and is the hollow fiber module of a hollow fiber bunch which it comes to paste an end airtightly at least with adhesives. The edge surface where a hollow fiber in a module is being fixed (A) The surface over which a hollow fiber currently fixed is distributed densely, and (B) It has the surface over which a hollow fiber currently fixed is not distributed on parenchyma, and is the surface (A). The surface (B) A hollow fiber module characterized by being divided into plurality.

[Claim 2] The surface of claim 1 (B) A hollow fiber module according to claim 1 with which width of face is characterized by being 3mm or more.

[Claim 3] It is the surface (A) according to claim 1 by using ready \*\*\*\* for holding a hollow fiber bunch for the interior of the adhesives solidification section. And the surface (B) A hollow fiber module according to claim 1 characterized by forming.

[Claim 4] A hollow fiber module according to claim 3 characterized by having buried ready \*\*\*\* according to claim 3 in the interior of the adhesives solidification section.

[Claim 5] A hollow fiber module according to claim 3 characterized by preparing a through tube for promoting circulation of adhesives and air other than space for carrying out penetration maintenance of the hollow fiber on ready \*\*\*\*.

[Claim 6] A hollow fiber module according to claim 1 characterized by arranging around a pipe a hollow fiber bunch by which a hollow fiber bunch was divided and divided into two or more bunches.

[Claim 7] A hollow fiber module according to claim 1 characterized by a hollow fiber which constitutes a hollow fiber module consisting of a polymer which uses acrylonitrile as at least 1 component.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the hollow fiber module for performing filtration actuation of a liquid.

[0002]

[Description of the Prior Art] if many SS components, a particle, dust, bacteria, algae, etc. are contained in common industrial water and it is used as it is -- service water -- it is easy to become the cause which produces troubles, such as plugging of piping, bacterial growth, and scale deposition in Rhine. In order to remove these underwater mixing components conventionally, various methods, such as sand filtration, condensation filtration, coagulation sedimentation filtration, and cartridge filtration, have been responded and used for a use. Filtration by the porous hollow fiber is beginning to put in practical use as the new technique of changing to such general filtration recently. The water treatment by the hollow fiber and filtration spread quickly in recent years, and are becoming large [ the Field of application ] every year.

[0003] In filtration of a hollow fiber, after a hollow fiber bundles what 1000 - what [ 10,000 ] in a bunch, it is processed into the goods gestalt of the configuration which fixed the edge with adhesives. And what was processed into these goods gestalten is called the hollow fiber module. As a hollow fiber module which can filter a liquid, the thing of many gestalten is proposed from the former. There are a filtration module used especially as an early thing combining a moderate pretreatment means, a thing aiming at reverse osmosis filtration, a thing aiming at a dialysis use, etc., many module gestalten are proposed by making these uses into a key objective, and when the main thing is mentioned, there are some which are indicated by JP,48-28380,B, JP,49-69550,A, JP,53-100176,A, etc. As for these all, in filtering a liquid, in throwing away or the phase in which dirt adhered more than the constant rate, it was common to have carried out washing and the Flushing processing by clarified water or drug solution water. On the other hand, a hollow fiber module configuration is elaborated recently and the method of carrying out engine-performance recovery of a hollow fiber by Ayr is tried. JP,61-263605,A includes a hollow fiber in a U character mold, contains and uses it for a container, makes Ayr introduce from the Ayr inlet periodically established in the lower part of a container, vibrates a hollow fiber by Ayr scrubbing, and tries removal of the sediment of a film surface. Moreover, JP,60-206415,A is the both-ends cover-half module which made the hollow fiber arrange around a central tube, and is said thing which includes in a container similarly and removes the sediment of a hollow fiber film surface by Ayr scrubbing. As for such technology, examination of utilization is already started.

[0004]

[Problem(s) to be Solved by the Invention] In the manufacture method of a hollow fiber module, although the attempt which makes a hollow fiber arrange around a central tube is generally used well, the following technical problem is left behind in the present module. That is, it is difficult to arrange what 1000 - what 10,000 \*\* for a hollow fiber equally around a central tube, and when both ends are closed for a hollow fiber with adhesives in an array and the condition of having tacking carried out, around a central tube, it is difficult [ it ] to obtain the hollow fiber module with which the hollow fiber bunch fell caudad with gravity, and was equally arranged in the hollow fiber in the setting time of adhesives. For this reason, the whole film is divided into two or more \*\*\*\* [ \*\*\*\* / covering by the thing of the shape of a network made from plastics ] in order to prevent this, and it is a network-like thing about each, and what arranged the cover film equally is common. Moreover, ready \*\*\*\* and a base material are installed in the length direction of \*\*\*\* at fixed interval, and the module which held \*\*\*\* and pressed down turbulence is also developed (publication number 1-307408, the real extraction of the square root 2-28723).

[0005] Carrying out the deer of these methods, in operation of a module, a film is swayed by Ayr scrubbing periodically or irregularly, when \*\*\*\* and \*\*\*\* are adopted in dust, dirt, etc. adhering to a film surface, the shake of a film is regulated by a network and ready \* \*\*\*, and the removal nature of an affix worsens. For this reason, [0006] which the affix removal nature by Ayr scrubbing was good for, and was asked for a means by which \*\*\*\* can be equally arranged around a central tube .

[Means for Solving the Problem] A hollow fiber bunch is contained in an outer case, and the purpose of this invention is a hollow fiber module of a hollow fiber bunch which it comes to paste an end airtightly at least with adhesives. The edge surface where a hollow fiber in a module is being fixed (A) The surface over which a hollow fiber currently fixed is distributed densely, and (B) It has the surface over which a hollow fiber currently fixed is not distributed on parenchyma, and is the surface (A). Surface (B) It is fundamentally attained by hollow fiber module characterized by being divided into plurality.

[0007]

[Function] Having the starting configuration, i.e., by dividing the hollow fiber into \*\*\*\*, the affix removal nature by Ayr scrubbing is good, and can arrange \*\*\*\* equally around a central tube. And since it is not necessary to install a network, ready \*\*\*\*, or a base material in the space in a module, there is also no possibility of damaging a hollow fiber.

[0008] Namely, the surface from which the hollow fiber currently fixed is not distributed over the edge surface on which the hollow fiber in a module is being fixed on parenchyma (B) By having, the space from which the hollow fiber is not distributed on parenchyma in a module is formed. By that cause, turbulence of a hollow fiber is controlled, and Ayr scrubbing acts on homogeneity, and affix removal nature improves. Since a processing-object fluid and a hollow fiber can exercise or exist freely, as for the starting space, Ayr scrubbing is carried out to homogeneity. Moreover, like a processing-object fluid or a hollow fiber, since a degree of hardness is lower than a hollow fiber, the material which exists in this space does not damage a film in the cases, such as Ayr scrubbing. In order to form the starting space, it is the aforementioned surface (B). Existing in both ends is desirable. It is the surface (B) of both ends still more preferably. A configuration is the same and it is the case where the portion to which both correspond faces correctly mutually like mirror image-related preferably especially. When it has the relation in which said corresponding portion was twisted, this space also serves as a twisted configuration and it becomes impossible for the effect of the invention in this application to fully demonstrate it. However, if it is the degree which un-arranging [ starting ] does not produce, it is the surface (B) of both ends. For example, it is satisfactory, even if configurations differ about 10% or it is making each other twist and face in less than 30 degrees at the rate of surface ratio.

[0009] Moreover, the surface (B) There is a possibility of a hollow fiber being somewhat prevented from a protrusion or being Ayr scrubbing etc. and vibrating if it has projected not much, although you may become depressed in a module, or hitting with a hollow fiber and damaging a film. therefore, the surface (B) the space where it sets and ready \*\*\*\* and the base materials of an except, such as a processing-object fluid and a hollow fiber, the structure, etc. exist -- the surface (A) from -- it is the measured height, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. On the other hand, it is the surface (B). When it has become depressed not much, abnormality stagnation of a processing fluid is caused and there is a possibility of becoming causes, such as contamination. therefore, the surface (B) the case where it has become depressed -- the surface (A) from -- it is the measured depth, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. But it is the surface (B) preferably. It has not projected or become depressed in the module, and is the surface (A). It is having the same height.

[0010] As for the number of partitions of a hollow fiber, two to about ten are desirable, and 3-6 are still more desirable. Although the film number of each division changes with magnitude of MOJURU, in a module with an outer diameter of 100mm, about 10000 are desirable from 1000 per bundle. Moreover, although especially the gap of the hollow fiber in \*\*\*\* is not limited, its 2mm or less is desirable, and it is 1mm or less more preferably.

[0011] Moreover, although being divided completely is desirable as for division, an imperfect division gestalt is sufficient as it like the petaloid connected in the center section. However, it divides in that case, and 100% or less into which others are divided of the length of the boundary line of a boundary portion of the length (the length of the line which extended smoothly the boundary line of the boundary portion currently divided into the portion connected without dividing and going out, and drew it virtually into it) of the portion connected without going out is desirable, and it is 50% or less more preferably. In addition, the setting method of a boundary line is the surface (A). Along with the outermost hollow fiber, it shall be because a smooth line is drawn.

[0012] Moreover, the surface (B) As for width of face, it is desirable that it is 3mm or more, and it is 4mm or more more preferably. The width of face in this case is good at the value evaluated by the minimum value or the average. As the average, one point is passed and it is the surface (B), for example. About the minimum length in the segment cut on a boundary, it is the surface (B). What is obtained by averaging about all the upper points is mentioned, or an axis is defined, and it is the perpendicular and surface (B). What is called for from the average of the length of the segment cut on a boundary is raised.

[0013] This application is the surface (B) as mentioned above. It is divided. That is, it does not divide by preparing the notch penetrated at the adhesion edges other than a central-tube portion. Therefore, since the appearance of the cross section (cross section perpendicularly cut to the modular major axis or the transit direction of a hollow fiber) of an adhesion edge can consider as the configuration near a simple circle or simple it, formation of an adhesion edge and modular creation are easy.

[0014] of course -- even if it has the notch which adhesion edges other than a central-tube portion penetrated when the advantage of the aforementioned formation or creation is taken into consideration although any modes other than the applied configuration are not eliminated -- the depth or width of face -- desirable -- 1/5 or less [ of a diameter ] -- more -- desirable -- 1/10 or less -- it is . Moreover, especially holes, such as such other pipes which have not been penetrated other than the penetrated notch, a sensor, etc., etc. are not eliminated.

[0015] The surface in the invention in this application (A) And the surface (B) Especially a means to form is the surface (A) by using ready \*\*\*\* for holding a hollow fiber bunch for the interior of the adhesives solidification section, although not limited. And the surface (B) The method of forming is raised. It is once the surface (A). And the surface (B) If a hollow fiber is fixed to a module edge in the condition of having been formed, since especially starting ready \*\*\*\* does not need any longer, it is also removable from the fixed-end section by exfoliating or decomposing. however -- since the starting removal is accompanied by difficulty in many cases -- as it is -- ready \*\*\*\* -- the interior of the adhesives solidification section -- a part -- or it may be buried altogether. The example in connection with this invention which explains the invention in this application more below at details using the mode in which ready \*\*\*\* was especially buried in the interior of the adhesives solidification section based on a drawing is shown in drawing 1 , drawing 3 , and drawing 4 .

[0016] The feedwater filtered is supplied from the nozzle 3 of a porosity hollow filament filtration membrane module (it is called a hollow fiber module below), is filtered by the countless micropore which has opened on the surface of the hollow fiber, and only the clarified water with which SS component, a particle, a contaminant, bacteria, etc. were removed penetrates it inside a hollow fiber, and it is taken out from the filtered water outlet 11 as filtered water. Although the amount of filtered water becomes large so that a raw water pressure is large in filtration of a hollow fiber module, said SS component, a particle, etc. adhere to a film surface with the filtration passage of time, the blinding of a hollow fiber arises to some extent, and, usually the amount of filtered water per same pressure falls gradually. Therefore, when [ suitable ] the blinding of a hollow fiber advances to eye a use \*\*\*\*\* many and the amount of filtered water falls a hollow fiber and

a module to it at a long period of time, washing actuation including Ayr scrubbing is performed, and it is necessary even for level near before blinding to recover the amount of filtered water of a hollow fiber.

[0017] In order to perform Ayr scrubbing on the whole film filled up by the container at rear-spring-supporter homogeneity and to raise a cleaning effect, it must stop having to be in the condition which set the membranous filling factor as the suitable range, and also distributed the film in the container at homogeneity.

[0018] When the hollow fiber 10 with which drawing 2 is general module structure and the container 1 was filled up had the high filling factor of a hollow fiber, \*\*\*\* moved also at the time of module manufacture for friction between hollow fibers, and \*\*\*\* was not confused. However, it turned out by Ayr scrubbing's etc. washing a film and carrying out repeat use that plugging by detergency also worsening and carrying out Ayr scrubbing to homogeneity, the dirt which near a raw water entrance sets, and the contaminant will be caused if it is a high filling factor in the module which needs a high life, especially the module which performs all filtration operations and high recovery operation. Although the filling factor of a hollow fiber must be made low for preventing these, if a module manufacture top is a low filling factor, detergency is not only bad, but the module with which the film was turbulence-easy with the module and was done will be distributed by the film to an ununiformity, and appearance will worsen. Manufacture was difficult especially when it was necessary to make homogeneity fill up especially the surroundings of a central tube with a thread.

[0019] this invention persons discover this invention, as a result of examining wholeheartedly the method of fabricating after the film has distributed to homogeneity in a container also in the hollow fiber module of this low filling factor.

[0020] The module fabricated in the condition of having used ready \*\*\*\* by this invention and having made \*\*\*\* penetrating in it does not have film turbulence, either, shaping becomes possible in the condition that \*\*\*\* distributed to homogeneity in the container in the form suitable for the configuration of ready \*\*\*\*, and washing actuation of Ayr scrubbing etc. becomes possible [ carrying out to homogeneity ]. Moreover, ready \*\*\*\* is making it buried into adhesives, and a film does not contact ready \*\*\*\* directly and it does not have a hollow fiber with a blemish, either.

[0021] Thus, it found out that the module which also distributed the low module of a film filling factor to homogeneity in the container could be manufactured by attaching ready \*\*\*\*. Drawing 1 is explanatory drawing of the module which used ready \*\*\*\* of this invention. Quadrisecion is distributed by carrying out a hollow fiber 10 around a central tube 4, and adhesives are enclosed and fabricated in the condition of having made ready \*\*\*\* 5 pasted up on the central tube penetrating a hollow fiber. It is what was cut to the location where a hollow fiber carries out the opening only of the single-sided jointing after adhesive setting, and one of the two already attaches the module cap 2 to the outside, closing. It is buried in adhesives and there is an Ayr outlet hole 7 for Ayr scrubbing from the pore opened to the central tube 4, the plug 9 is inserted in the central-tube hole so that Ayr may not fall out in the opposite side, and ready \*\*\*\* 5 has structure which Ayr and raw water do not mix in a filtered water side.

[0022] By the membranous number of partitions, ready \*\*\*\* has a thing various type and showed an example to drawing 3 and drawing 4. It is important for ready \*\*\*\* in order to carry out penetration maintenance of the hollow fiber bunch, to be processed so that there may be no hollow fiber with a blemish, and there may be no weld flash, and the injection molding article which smoothed the hollow fiber contact section is used.

[0023] Although especially the configuration of ready \*\*\*\* is not limited, it is desirable that it is disc-like. Although the outer diameter of disc-like ready \*\*\*\* needs the bore of the applicable portion of the outer case incorporating ready \*\*\*\*, this size, or a small thing, in order to raise the fluidity of adhesives, especially the thing established for space between an outer case inside and a ready \*\*\*\* periphery is desirable.

[0024] Furthermore, it is most desirable to make it the structure from which prepares the through tube for degassing in the partition portion of ready \*\*\*\*, and Ayr in the adhesives at the time of shaping tends to escape. The diameter  $\phi$  of 1-5mm has [ the magnitude of a through tube / that what is necessary is just the hole which is the degree from which Ayr escapes ] at best still more preferably good 2-3mm $\phi$ . Although it is so good that there are as much as possible many penetration openings, since it divides by the membranous number and the thickness of a portion is restricted, it is effective when 2-3 holes are made in the partition which is usually one. Although setting of a central tube is very easy if the hole for central tubes for penetration of a central tube is made in ready \*\*\*\*, this invention may not necessarily be premised on having a central tube, and may have only the hole 14 which lets a thread pass like drawing 4, and the hole 14 which lets the through tube 13 for degassing, or a thread pass.

[0025] Although the quality of the material of ready \*\*\*\* does not have especially assignment, in consideration of adhesives nature, the same quality of the material as a container and a central tube is desirable on processing, and, generally a polyvinyl chloride, a polycarbonate, ABS plastics, polysulfone, a polyphenylene sulfide, a polyether ether ketone, etc. are used preferably.

[0026] Moreover, as adhesives used in order to paste up the hollow fiber used for this invention, urethane system adhesives, epoxy system adhesives, silicon system adhesives, etc. can be used broadly.

[0027] Although it will not limit to porosity as a hollow fiber material which constitutes the hollow fiber module used for this invention especially if it is a hollow fiber, the quality of the material of polyethylene, polypropylene, polysulfone, polyether sulphone, polyvinyl alcohol, cellulose acetate, a polyacrylonitrile, and others can be chosen. In this, the hollow fiber which consists of a polymer which uses acrylonitrile as at least 1 component as a desirable hollow fiber material especially is suitable. It is the acrylonitrile system polymer which consists preferably of 0-40-mol % at least more than 50 mol %, a vinyl compound kind which has copolymerization nature to more than 60 mol % and this acrylonitrile preferably, or two sorts or more 50% or less in acrylonitrile. Moreover, mixture with two or more sorts of these acrylonitrile system polymers and the polymer of further others is sufficient. That what is necessary is just the well-known compound which has copolymerization nature to acrylonitrile as the above-mentioned vinyl compound, although not limited especially, as this better \*\*\*\*\*, an acrylic acid, an itaconic acid, a methyl acrylate, a methyl methacrylate, vinyl acetate, allyl compound sulfonic-acid soda, p-sodium styrenesulfonate, etc. can be illustrated.

[0028]

[Example]

It let one bundle pass at a time to ready \*\*\*\* attached in the location of about 100mm, respectively from the both ends of the central tube with a length of 1110mm with which 24 2mmphi holes opened the hollow fiber bunch which divided 10000 hollow fibers of a polyacrylonitrile with an outer diameter [ example 1 / of 850 micrometers ], and a bore of 350 micrometers into 2500 and four bundles to some pipes. After filling up inside with this at outer-diameter 114mmphi and a transparency outer case with a bore [ phi ] of 100mm and carrying out the seal of the both ends, 250g was supplied so that it might set to a centrifugal molding machine and adhesives might bisect adhesives from nozzle opening of an outer case during rotation, and 500g of adhesives was further thrown in after 30 minutes. One of the two of an outer case was cut 20mm with the chip saw type slicing machine after adhesive setting. Furthermore, the cap was pasted up on outer case both sides, and the module was manufactured. Four bundles of hollow fiber bunches which constitute the manufactured module are completely arranged at homogeneity, and single-yarn turbulence was not observed by each thread. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set using this so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5. Since the film surface became dirty brown when it let water flow directly between 24, when Ayr scrubbing was performed for 5 minutes by part for amount/of 30l. of Ayr, by the time the dirt of a film surface was not different from before exterior water flow, it was recovered. The supply pressure when starting again was 0.50kg/cm<sup>2</sup>.

[0029] When example of comparison 1 central tube and ready \*\*\*\* were not used and also the module was manufactured by the same method as an example 1, it turned out that \*\*\*\* inclines toward one of the two. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5 using this module. Since the film surface became dirty brown when it let water flow for 24 hours, when Ayr scrubbing was performed for [ amount / of 30l. / of Ayr ] a part for /, and 5 minutes, it almost passed along the place where a film does not have Ayr, and the dirt of a film surface hardly came off. The supply pressure when starting again was 0.60kg/cm<sup>2</sup>.

[0030]

[Effect of the Invention] By this invention, continuation filtration of the liquid containing a particle or a suspended solid is carried out, and the hollow fiber module which can remove the blinding of a hollow fiber by moreover performing Ayr scrubbing periodically is offered.

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**TECHNICAL FIELD**

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[Industrial Application] This invention relates to the hollow fiber module for performing filtration actuation of a liquid.

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PRIOR ART

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[Description of the Prior Art] if many SS components, a particle, dust, bacteria, algae, etc. are contained in common industrial water and it is used as it is -- service water -- it is easy to become the cause which produces troubles, such as plugging of piping, bacterial growth, and scale deposition in Rhine. In order to remove these underwater mixing components conventionally, various methods, such as sand filtration, condensation filtration, coagulation sedimentation filtration, and cartridge filtration, have been responded and used for a use. Filtration by the porous hollow fiber is beginning to put in practical use as the new technique of changing to such general filtration recently. The water treatment by the hollow fiber and filtration spread quickly in recent years, and are becoming large [ the Field of application ] every year.

[0003] In filtration of a hollow fiber, after a hollow fiber bundles what 1000 - what [ 10,000 ] in a bunch, it is processed into the goods gestalt of the configuration which fixed the edge with adhesives. And what was processed into these goods gestalten is called the hollow fiber module. As a hollow fiber module which can filter a liquid, the thing of many gestalten is proposed from the former. There are a filtration module used especially as an early thing combining a moderate pretreatment means, a thing aiming at reverse osmosis filtration, a thing aiming at a dialysis use, etc., many module gestalten are proposed by making these uses into a key objective, and when the main thing is mentioned, there are some which are indicated by JP,48-28380,B, JP,49-69550,A, JP,53-100176,A, etc. As for these all, in filtering a liquid, in throwing away or the phase in which dirt adhered more than the constant rate, it was common to have carried out washing and the Flushing processing by clarified water or drug solution water. On the other hand, a hollow fiber module configuration is elaborated recently and the method of carrying out engine-performance recovery of a hollow fiber by Ayr is tried. JP,61-263605,A includes a hollow fiber in a U character mold, contains and uses it for a container, makes Ayr introduce from the Ayr inlet periodically established in the lower part of a container, vibrates a hollow fiber by Ayr scrubbing, and tries removal of the sediment of a film surface. Moreover, JP,60-206415,A is the both-ends cover-half module which made the hollow fiber arrange around a central tube, and is said thing which includes in a container similarly and removes the sediment of a hollow fiber film surface by Ayr scrubbing. As for such technology, examination of utilization is already started.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] By this invention, continuation filtration of the liquid containing a particle or a suspended solid is carried out, and the hollow fiber module which can remove the blinding of a hollow fiber by moreover performing Ayr scrubbing periodically is offered.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] In the manufacture method of a hollow fiber module, although the attempt which makes a hollow fiber arrange around a central tube is generally used well, the following technical problem is left behind in the present module. That is, it is difficult to arrange what 1000 - what 10,000 \*\* for a hollow fiber equally around a central tube, and when both ends are closed for a hollow fiber with adhesives in an array and the condition of having tacking carried out, around a central tube, it is difficult [ it ] to obtain the hollow fiber module with which the hollow fiber bunch fell caudad with gravity, and was equally arranged in the hollow fiber in the setting time of adhesives. For this reason, the whole film is divided into two or more \*\*\*\* [ \*\*\*\* / covering by the thing of the shape of a network made from plastics ] in order to prevent this, and it is a network-like thing about each, and what arranged the cover film equally is common. Moreover, ready \*\*\*\* and a base material are installed in the length direction of \*\*\*\* at fixed interval, and the module which held \*\*\*\* and pressed down turbulence is also developed (publication number 1-307408, the real extraction of the square root 2-28723).

[0005] Carrying out the deer of these methods, in operation of a module, a film is swayed by Ayr scrubbing periodically or irregularly, when \*\*\*\*\* and \*\*\*\*\* are adopted in dust, dirt, etc. adhering to a film surface, the shake of a film is regulated by a network and ready \* \*\*\*, and the removal nature of an affix worsens. For this reason, the affix removal nature by Ayr scrubbing was good, and a means by which \*\*\*\* could be equally arranged around a central tube was searched for. [0006] .

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MEANS

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[Means for Solving the Problem] A hollow fiber bunch is contained in an outer case, and the purpose of this invention is a hollow fiber module of a hollow fiber bunch which it comes to paste an end airtightly at least with adhesives. The edge surface where a hollow fiber in a module is being fixed (A) The surface over which a hollow fiber currently fixed is distributed densely, and (B) It has the surface over which a hollow fiber currently fixed is not distributed on parenchyma, and is the surface (A). Surface (B) It is fundamentally attained by hollow fiber module characterized by being divided into plurality.

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## OPERATION

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[Function] Having the starting configuration, i.e., by dividing the hollow fiber into \*\*\*\*, the affix removal nature by Ayr scrubbing is good, and can arrange \*\*\*\* equally around a central tube. And since it is not necessary to install a network, ready \*\*\*\*, or a base material in the space in a module, there is also no possibility of damaging a hollow fiber.

[0008] Namely, the surface from which the hollow fiber currently fixed is not distributed over the edge surface on which the hollow fiber in a module is being fixed on parenchyma (B) By having, the space from which the hollow fiber is not distributed on parenchyma in a module is formed. By that cause, turbulence of a hollow fiber is controlled, and Ayr scrubbing acts on homogeneity, and affix removal nature improves. Since a processing-object fluid and a hollow fiber can exercise or exist freely, as for the starting space, Ayr scrubbing is carried out to homogeneity. Moreover, like a processing-object fluid or a hollow fiber, since a degree of hardness is lower than a hollow fiber, the material which exists in this space does not damage a film in the cases, such as Ayr scrubbing. In order to form the starting space, it is the aforementioned surface (B). Existing in both ends is desirable. It is the surface (B) of both ends still more preferably. A configuration is the same and it is the case where the portion to which both correspond faces correctly mutually like mirror image-related preferably especially. When it has the relation in which said corresponding portion was twisted, this space also serves as a twisted configuration and it becomes impossible for the effect of the invention in this application to fully demonstrate it. However, if it is the degree which un-arranging [ starting ] does not produce, it is the surface (B) of both ends. For example, it is satisfactory, even if configurations differ about 10% or it is making each other twist and face in less than 30 degrees at the rate of surface ratio.

[0009] Moreover, the surface (B) There is a possibility of a hollow fiber being somewhat prevented from a protrusion or being Ayr scrubbing etc. and vibrating if it has projected not much, although you may become depressed in a module, or hitting with a hollow fiber and damaging a film. therefore, the surface (B) the space where it sets and ready \*\*\*\* and the base materials of an except, such as a processing-object fluid and a hollow fiber, the structure, etc. exist -- the surface (A) from -- it is the measured height, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. On the other hand, it is the surface (B). When it has become depressed not much, abnormality stagnation of a processing fluid is caused and there is a possibility of becoming causes, such as contamination. therefore, the surface (B) the case where it has become depressed -- the surface (A) from -- it is the measured depth, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. But it is the surface (B) preferably. It has not projected or become depressed in the module, and is the surface (A). It is having the same height.

[0010] As for the number of partitions of a hollow fiber, two to about ten are desirable, and 3-6 are still more desirable. Although the film number of each division changes with magnitude of MOJURU, in a module with an outer diameter of 100mm, about 10000 are desirable from 1000 per bundle. Moreover, although especially the gap of the hollow fiber in \*\*\*\* is not limited, its 2mm or less is desirable, and it is 1mm or less more preferably.

[0011] Moreover, although being divided completely is desirable as for division, an imperfect division gestalt is sufficient as it like the petaloid connected in the center section. However, it divides in that case, and 100% or less into which others are divided of the length of the boundary line of a boundary portion of the length (the length of the line which extended smoothly the boundary line of the boundary portion currently divided into the portion connected without dividing and going out, and drew it virtually into it) of the portion connected without going out is desirable, and it is 50% or less more preferably. In addition, the setting method of a boundary line is the surface (A). Along with the outermost hollow fiber, it shall be because a smooth line is drawn.

[0012] Moreover, the surface (B) As for width of face, it is desirable that it is 3mm or more, and it is 4mm or more more preferably. The width of face in this case is good at the value evaluated by the minimum value or the average. As the average, one point is passed and it is the surface (B), for example. About the minimum length in the segment cut on a boundary, it is the surface (B). What is obtained by averaging about all the upper points is mentioned, or an axis is defined, and it is the perpendicular and surface (B). What is called for from the average of the length of the segment cut on a boundary is raised.

[0013] This application is the surface (B) as mentioned above. It is divided. That is, it does not divide by preparing the notch penetrated at the adhesion edges other than a central-tube portion. Therefore, since the appearance of the cross section (cross section perpendicularly cut to the modular major axis or the transit direction of a hollow fiber) of an adhesion edge can consider as the configuration near a simple circle or simple it, formation of an adhesion edge and modular creation are easy.

[0014] of course -- even if it has the notch which adhesion edges other than a central-tube portion penetrated when the advantage of the aforementioned formation or creation is taken into consideration although any modes other than the applied configuration are not eliminated -- the depth or width of face -- desirable -- 1/5 or less [ of a diameter ] -- more -- desirable -- 1/10 or less -- it is . Moreover, especially holes, such as such other pipes which have not been penetrated other than the penetrated notch, a sensor, etc., etc. are not eliminated.

[0015] The surface in the invention in this application (A) And the surface (B) Especially a means to form is the surface (A) by using ready \*\*\*\* for holding a hollow fiber bunch for the interior of the adhesives solidification section, although not limited. And the surface (B) The method of forming is raised. It is once the surface (A). And the surface (B) If a hollow fiber is fixed to a module edge in the condition of having been formed, since especially starting ready \*\*\*\* does not need any longer, it is also removable from the fixed-end section by exfoliating or decomposing. however -- since the starting removal is accompanied by difficulty in many cases -- as it is -- ready \*\*\*\* -- the interior of the adhesives solidification section -- a part -- or it may be buried altogether. The example in connection with this invention which explains the invention in this application more below at details using the mode in which ready \*\*\*\* was especially buried in the interior of the adhesives solidification section based on a drawing is shown in drawing 1 , drawing 3 , and drawing 4 .

[0016] The feedwater filtered is supplied from the nozzle 3 of a porosity hollow filament filtration membrane module (it is called a hollow fiber module below), is filtered by the countless micropore which has opened on the surface of the hollow fiber, and only the clarified water with which SS component, a particle, a contaminant, bacteria, etc. were removed penetrates it inside a hollow fiber, and it is taken out from the filtered water outlet 11 as filtered water. Although the amount of filtered water becomes large so that a raw water pressure is large in filtration of a hollow fiber module, said SS component, a particle, etc. adhere to a film surface with the filtration passage of time, the blinding of a hollow fiber arises to some extent, and, usually the amount of filtered water per same pressure falls gradually. Therefore, when [ suitable ] the blinding of a hollow fiber advances to eye a use \*\*\*\*\* many and the amount of filtered water falls a hollow fiber and a module to it at a long period of time, washing actuation including Ayr scrubbing is performed, and it is necessary even for level near before blinding to recover the amount of filtered water of a hollow fiber.

[0017] In order to perform Ayr scrubbing on the whole film filled up by the container at rear-spring-supporter homogeneity and to raise a cleaning effect, it must stop having to be in the condition which set the membranous filling factor as the suitable range, and also distributed the film in the container at homogeneity.

[0018] When the hollow fiber 10 with which drawing 2 is general module structure and the container 1 was filled up had the high filling factor of a hollow fiber, \*\*\*\* moved also at the time of module manufacture for friction between hollow fibers, and \*\*\*\* was not confused. However, it turned out by Ayr scrubbing's etc. washing a film and carrying out repeat use that plugging by detergency also worsening and carrying out Ayr scrubbing to homogeneity, the dirt which near a raw water entrance sets, and the contaminant will be caused if it is a high filling factor in the module which needs a high life, especially the module which performs all filtration operations and high recovery operation. Although the filling factor of a hollow fiber must be made low for preventing these, if a module manufacture top is a low filling factor, detergency is not only bad, but the module with which the film was turbulence-easy with the module and was done will be distributed by the film to an ununiformity, and appearance will worsen. Manufacture was difficult especially when it was necessary to make homogeneity fill up especially the surroundings of a central tube with a thread.

[0019] this invention persons discover this invention, as a result of examining wholeheartedly the method of fabricating after the film has distributed to homogeneity in a container also in the hollow fiber module of this low filling factor.

[0020] The module fabricated in the condition of having used ready \*\*\*\* by this invention and having made \*\*\*\* penetrating in it does not have film turbulence, either, shaping becomes possible in the condition that \*\*\*\* distributed to homogeneity in the container in the form suitable for the configuration of ready \*\*\*\*, and washing actuation of Ayr scrubbing etc. becomes possible [ carrying out to homogeneity ]. Moreover, ready \*\*\*\* is making it buried into adhesives, and a film does not contact ready \*\*\*\* directly and it does not have a hollow fiber with a blemish, either.

[0021] Thus, it found out that the module which also distributed the low module of a film filling factor to homogeneity in the container could be manufactured by attaching ready \*\*\*\*. Drawing 1 is explanatory drawing of the module which used ready \*\*\*\* of this invention. Quadrissection is distributed by carrying out a hollow fiber 10 around a central tube 4, and adhesives are enclosed and fabricated in the condition of having made ready \*\*\*\* 5 pasted up on the central tube penetrating a hollow fiber. It is what was cut to the location where a hollow fiber carries out the opening only of the single-sided jointing after adhesive setting, and one of the two already attaches the module cap 2 to the outside, closing. It is buried in adhesives and there is an Ayr outlet hole 7 for Ayr scrubbing from the pore opened to the central tube 4, the plug 9 is inserted in the central-tube hole so that Ayr may not fall out in the opposite side, and ready \*\*\*\* 5 has structure which Ayr and raw water do not mix in a filtered water side.

[0022] By the membranous number of partitions, ready \*\*\*\* has a thing various type and showed an example to drawing 3 and drawing 4 . It is important for ready \*\*\*\* in order to carry out penetration maintenance of the hollow fiber bunch, to be processed so that there may be no hollow fiber with a blemish, and there may be no weld flash, and the injection molding article which smoothed the hollow fiber contact section is used.

[0023] Although especially the configuration of ready \*\*\*\* is not limited, it is desirable that it is disc-like. Although the outer diameter of disc-like ready \*\*\*\* needs the bore of the applicable portion of the outer case incorporating ready \*\*\*\*, this size, or a small thing, in order to raise the fluidity of adhesives, especially the thing established for space between an outer case inside and a ready \*\*\*\* periphery is desirable.

[0024] Furthermore, it is most desirable to make it the structure from which prepares the through tube for degassing in the partition portion of ready \*\*\*\*, and Ayr in the adhesives at the time of shaping tends to escape. The diameter phi of 1-5mm has [ the magnitude of a through tube / that what is necessary is just the hole which is the degree from which Ayr escapes ] at best still more preferably good 2-3mmphi. Although it is so good that there are as much as possible many penetration openings, since it divides by the membranous number and the thickness of a portion is restricted, it is effective when 2-3 holes are made in the partition which is usually one. Although setting of a central tube is very easy if the hole for central tubes for penetration of a central tube is made in ready \*\*\*\*, this invention may not necessarily be premised on having a central tube, and may have only the hole 14 which lets a thread pass like drawing 4 , and the hole 14 which lets the through tube 13 for degassing, or a thread pass.

[0025] Although the quality of the material of ready \*\*\*\* does not have especially assignment, in consideration of adhesives nature, the same quality of the material as a container and a central tube is desirable on processing, and, generally a polyvinyl chloride, a polycarbonate, ABS plastics, polysulfone, a polyphenylene sulfide, a polyether ether ketone, etc. are used preferably.

[0026] Moreover, as adhesives used in order to paste up the hollow fiber used for this invention, urethane system adhesives, epoxy system adhesives, silicon system adhesives, etc. can be used broadly.

[0027] Although it will not limit to porosity as a hollow fiber material which constitutes the hollow fiber module used for this invention especially if it is a hollow fiber, the quality of the material of polyethylene, polypropylene, polysulfone, polyether sulphone, polyvinyl alcohol, cellulose acetate, a polyacrylonitrile, and others can be chosen. In this, the hollow fiber which consists of a polymer which uses acrylonitrile as at least 1 component as a desirable hollow fiber material especially is suitable. It is the acrylonitrile system polymer which consists preferably of 0-40-mol % at least more than 50 mol %, a vinyl compound kind which has copolymerization nature to more than 60 mol % and this acrylonitrile preferably, or two sorts or more 50% or less in acrylonitrile. Moreover, mixture with two or more sorts of these acrylonitrile system polymers and the polymer of further others is sufficient. That what is necessary is just the well-known compound which has copolymerization nature to acrylonitrile as the above-mentioned vinyl compound, although not limited especially, as this better \*\*\*\*\*, an acrylic acid, an itaconic acid, a methyl acrylate, a methyl methacrylate, vinyl acetate, allyl compound sulfonic-acid soda, p-sodium styrenesulfonate, etc. can be illustrated.

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[Translation done.]

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EXAMPLE

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[Example]

It let one bundle pass at a time to ready \*\*\*\* attached in the location of about 100mm, respectively from the both ends of the central tube with a length of 1110mm with which 24 2mmphi holes opened the hollow fiber bunch which divided 10000 hollow fibers of a polyacrylonitrile with an outer diameter [ example 1 / of 850 micrometers ], and a bore of 350 micrometers into 2500 and four bundles to some pipes. After filling up inside with this at outer-diameter 114mmphi and a transparence outer case with a bore [ phi ] of 100mm and carrying out the seal of the both ends, 250g was supplied so that it might set to a centrifugal molding machine and adhesives might bisect adhesives from nozzle opening of an outer case during rotation, and 500g of adhesives was further thrown in after 30 minutes. One of the two of an outer case was cut 20mm with the chip sow type slicing machine after adhesive setting. Furthermore, the cap was pasted up on outer case both sides, and the module was manufactured. Four bundles of hollow fiber bunches which constitute the manufactured module are completely arranged at homogeneity, and single-yarn turbulence was not observed by each thread. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set using this so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5. Since the film surface became dirty brown when it let water flow directly between 24, when Ayr scrubbing was performed for 5 minutes by part for amount/of 30l. of Ayr, by the time the dirt of a film surface was not different from before exterior water flow, it was recovered. The supply pressure when starting again was 0.50kg/cm<sup>2</sup>.

[0029] When example of comparison 1 central tube and ready \*\*\*\* were not used and also the module was manufactured by the same method as an example 1, it turned out that \*\*\*\* inclines toward one of the two. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5 using this module. Since the film surface became dirty brown when it let water flow for 24 hours, when Ayr scrubbing was performed for [ amount / of 30l. / of Ayr ] a part for /, and 5 minutes, it almost passed along the place where a film does not have Ayr, and the dirt of a film surface hardly came off. The supply pressure when starting again was 0.60kg/cm<sup>2</sup>.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The configuration schematic diagram of the module which used ready \*\*\*\* of this invention

[Drawing 2] The outline block diagram of the conventional module

[Drawing 3] An example of ready \*\*\*\* which has the hole of a central tube

[Drawing 4] An example of ready \*\*\*\* which does not have the hole of a central tube

[Description of Notations]

- 1: Outer case (container)
- 2: Module cap
- 3: Nozzle
- 4: Central tube
- 5: Ready \*\*\*\*
- 6: Encapsulant (adhesives)
- 7: Ayr Ko Deguchi
- 8: Ayr feed hopper
- 9: Plug
- 10: Hollow fiber
- 11: Filtered water outlet
- 12: Degassing hole
- 13: Central-tube catching hole
- 14: Hollow fiber through hole

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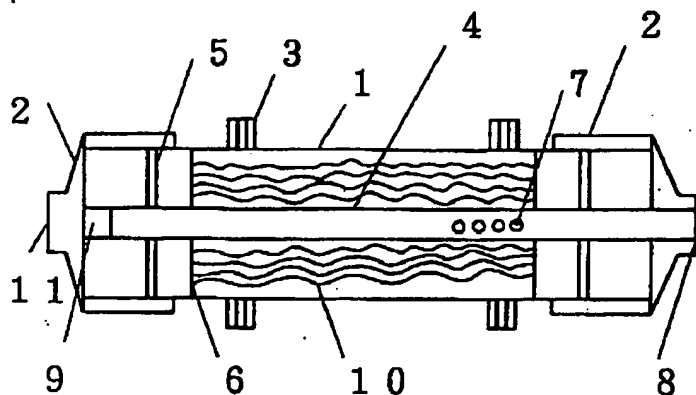
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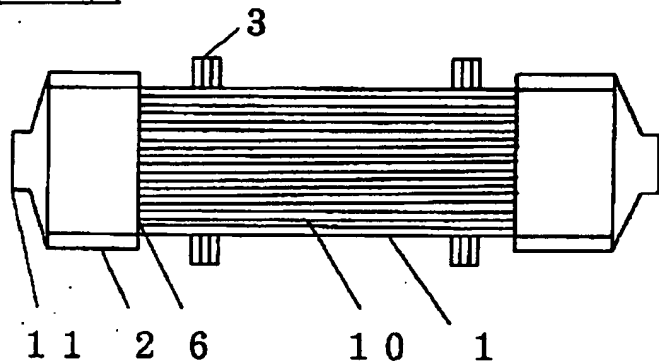
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## DRAWINGS

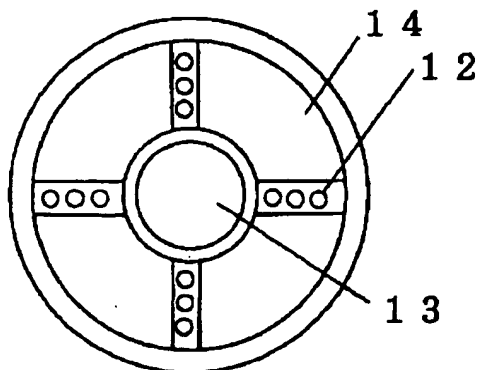
[Drawing 1]



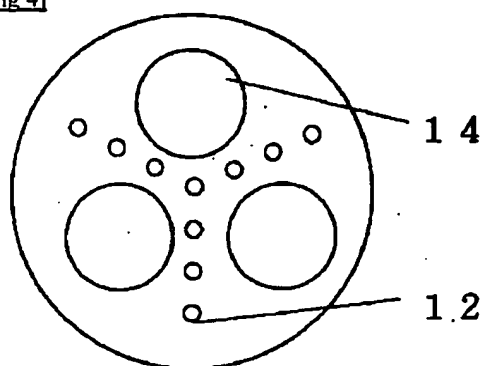
[Drawing 2]



[Drawing 3]



[Drawing 4]




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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-136471

(43)Date of publication of application : 30.05.1995

(51)Int.Cl. B01D 63/02  
B01D 63/00

(21)Application number : 05-285058

(71)Applicant : TORAY IND INC

(22)Date of filing : 15.11.1993

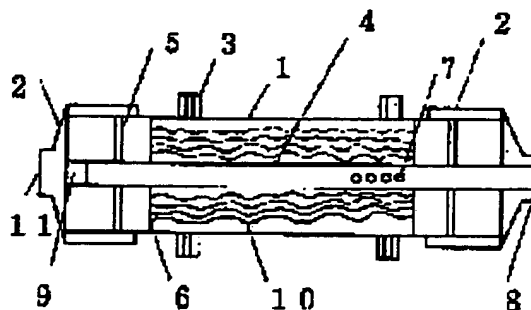
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## (54) HOLLOW YARN MEMBRANE MODULE

### (57)Abstract:

**PURPOSE:** To improve the removing efficiency of a bonded substance by air scrubbing by providing a surface having hollow yarn membranes densely distributed thereon and a surface having no hollow yarn membranes distributed thereon to the surface of the end part to which hollow yarn bundles are fixed in a module to separate the end part into a plurality of sections by the surfaces A, B.

**CONSTITUTION:** The bundles of hollow yarn membranes 10 are received in an outer cylinder 1 and at least one ends thereof are bonded airtightly by an adhesive 6. In this hollow yarn membrane module, a surface A having the fixed hollow yarn membranes 10 densely distributed thereon and a surface B having the fixed hollow yarn membranes 10 not substantially distributed thereon are provided to the surface of the end part to which the hollow yarn membranes 10 are fixed in the module and the surface of the end part is separated into a plurality of sections by the surfaces A, B. As a result, the hollow yarn membrane module improved in clogging removing effect due to air scrubbing to a large extent can be obtained.



## LEGAL STATUS

[Date of request for examination]

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[Number of appeal against examiner's decision of rejection]

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